AIRS/AMSU/HSB Version 5 Level 1B QA Quick Start

Edited by:
Edward T. Olsen

Contributions by:

H.H. Aumann, S. Broberg, S. Gaiser, M. Kapoor, M. Weiler

Jet Propulsion Laboratory, California Institute of Technology

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Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA

Submit Questions to:
http://airs.jpl.nasa.gov/AskAirs

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Introduction

There are many Quality Assurance parameters that a user of may use to filter AIRS/AMSU/HSB data to create a subset for analysis. A complete description is provided in the file,

V5_Released_ProcFileDesc.pdf

The novice user will find the plethora of QA parameters overwhelming, hence this document provides a quick start identification of the most basic QA parameters that a user should access before using any data for analysis. The QA parameters may be static or dynamic. If dynamic, their timescale and scope can range from global to all channels to per footprint to a single channel in a footprint.

Quick Start QA for AIRS L1B Data

Quality Checks

The properties of the 2378 AIRS instrument detectors are individually listed in self-documenting text files. Some properties of the channels change slowly with time or discontinuously whenever the instrument is warmed by a spacecraft safety shutdown or in a defrost cycle. Whenever this occurs, a recalibration exercise is performed and a new channel properties file is created. Thus a series of these files will result. The L1B PGE must use the proper one (chosen by date of properties file and date of data) for initial processing and reprocessing.

The file names contain a date, identifying the first date for which they are valid (and supersede a calibration properties file and channel properties file containing an earlier date). As of this release, there are six files of each type covering the time period from 8/30/02 to the present. Text versions are provided as ancillary files to this document:

Calibration Properties Files
L1B.cal_prop.2002.08.30.v9.5.0.txt
L1B.cal_prop.2002.09.17. v9.5.0.txt
L1B.cal_prop.2002.10.22. v9.5.0.txt
L1B.cal_prop.2003.01.10. v9.5.0.txt
L1B.cal_prop.2003.11.19. v9.5.0.txt
L1B.cal_prop.2005.03.01. v9.5.0.txt

Channel Properties Files
L2.chan_prop.2002.08.30.v9.5.1.txt
L2.chan_prop.2002.09.17. v9.5.1.txt
L2.chan_prop.2002.10.22. v9.5.1.txt
L2.chan_prop.2003.01.10. v9.5.1.txt
L2.chan_prop.2003.11.19. v9.5.1.txt
L2.chan_prop.2005.03.01. v9.5.1.txt

We recommend users choosing L1B radiances for their research use the calibration properties files rather than the channel properties files. The information contained in the former set has been expanded with the user in mind and will be of greater utility for selecting channels. The latter set is provided for continuity and its primary function is to support the Level 2 software. We are planning to phase out the channel properties files in later releases. Both sets of files include a documenting header describing their contents.

The calibration properties files provide the quality indicators on a per-channel basis. Key indicators are the frequency centroids and widths, NEdT at 250 K and 300 K, spatial centroids, **AB-weight**, **Spec_qual**, **n3sigma** and **npops**. We recommend that users filter channels by requiring that **Spec_qual** = 1 (or both 1 and 2) and **npops** ≤ 1 and **NEdt250** ≤ 1 K.. Users may work out an effective NEdT for any scene temperature from the values quoted at 250 K and 300 K. They may also choose to further filter channels by thresholding on **n3sigma**.

The L1B AIRS Radiance Product files contain dynamic quality indicators, on-the-fly estimates of noise and indicators of abnormal behavior by the instrument or algorithms.

Evaluate Candidate Channel Spectrally

- Check the **Spec_qual** field in appropriate (by date) calibration properties file and avoid using channels for which **Spec_qual** > 2. A more rigorous test is to require that **Spec_qual** = 1.

Evaluate Candidate Channel Radiometrically

- Check the **NEdT250** field in appropriate (by date) calibration properties file and avoid using channels for which **NedT250** > 1 K
- Check the **npops** field in the appropriate (by date) calibration properties file and avoid using channels for which **npops** > 1.
- Pick a noise limit and filter out channels exceeding it using dynamic **Min_NEdT250** and **Max_NEdT250**.
- Exclude channels having nonzero **CalChanSummary** (a 2378 element attribute in the L1B radiance granules). A zero means the channel was well calibrated for all scanlines in the granule.

Evaluate Candidate Channel Spatially

If sensitivity to channel co-registration is a concern:

- Check the X- and Y- centroid fields in the appropriate (by date) calibration properties and avoid using channels with absolute values greater than 0.25 degree, or
- Use the **Sceneinhomogeneous** flag, the **Rdiff_swindow** and **Rdiff_lwindow** flags and/or the radiances themselves to restrict data selection to uniform scenes where co-registration is not an issue. All flags are full swath fields, i.e. there is a value for each of the 90x135 AIRS footprints in the L1B radiance granule.

Additional Per-Scan-Per-Channel Quality Checks

The AIRS L1B product contains a per-scan field named “**CalFlag**”. Users should avoid using any channel for any scan in which the "**offset problem**" or "**gain problem**", or "**pop detected**" bits are set (bits 6, 5, and 4 respectively where bit 0 is LSB). Bit 0, “**cold scene noise**”, and bit 1, “**telemetry out of limit condition**”, indicates conditions that can potentially impact data quality. Users who require pristine data should discard any data in which either of these bits is set.

Additional Per-Field-of-View Quality Checks

Before using any AIRS L1B radiance, check the value of the corresponding "**state**" to ensure that it is equal to zero. There is one "**state**" value per field-of-view (FOV), and it is valid for all 2378 channels in that FOV. The "**state**" valids and their meaning are:

State Valid	State Value	Meaning
Process	0	normal data
Special	1	instrument in special calibration mode when these data were taken (e.g., staring at nadir)
Erroneous	2	data known bad (e.g., instrument in safe mode)
Missing	3	data are missing

Additional Per-Channel Quality Checks

Individual channel readings ("**radiances**") must be checked for the flag bad value of **–9999.0**. A channel reading is set to this value only when no radiance can be calculated; questionable or suspect values are indicated only by QA fields.

Note that small negative radiances for shortwave channels (2000 to 2700 cm^{-1}) are rare, but valid. These negative radiances values are due to instrument noise, and occur when the scene temperatures drop below 190K, for example, over very high cloud or very cold surface.

Advanced Quality Checks

Each scan contains a "**glintlat**" and "**glintlon**" giving the location of the solar glint center at the time in the middle of that scan. Users can use these or the per-field-of-view "**sun_glint_distance**" to check for possibility of solar glint contamination.

Infrared glints can occur over clouds as well as water and can extend up to several hundred km.

Note that there are two spectral SRF centroids listed: **nominal_freq** and **spectral_freq**. Ignore **spectral_freq** and **spectral_freq_unc**. These latter two

fields are instantaneous estimates and therefore noisy. They should not be relied upon as QA indicators.

Quick Start QA for AMSU-A L1B Data

Special Note for AMSU Channel 7

AMSU channel 7 exhibits abnormal noise levels. Avoid using radiances from this channel unless averaging, smoothing or other noise reduction processing is part of your analysis. Please refer to the AMSU liens list in the Data Disclaimer documentation for details.

V5_Data_Disclaimer.pdf

Per-Scan Quality Checks

Before using any AMSU-A1 or AMSU-A2 L1B brightness temperature, check the value of the corresponding "**state1**" or "**state2**" to ensure that it is equal to zero.

There is one "**state1**" value for all 30 fields-of-view of a scan, and it is valid for all AMSU-A1 channels (AMSU-A channels 3 through 15).

There is one "**state2**" value for all 30 fields-of-view of a scan, and it is valid for all AMSU-A2 channels (AMSU-A channels 1 and 2).

The "**state1**" and "**state2**" valids and their meaning are:

State Valid	State Value	Meaning
Process	0	normal data
Special	1	instrument in special calibration mode when these data were taken (e.g., staring at nadir)
Erroneous	2	data known bad (e.g., instrument in safe mode)
Missing	3	data are missing

Per-Channel Quality Checks

Individual channel readings ("**antenna_temp**" or "**brightness_temp**") must be checked for the flag bad value of **–9999.0**. A channel reading is set to this value by the PGE when no actual antenna temperature value can be calculated.

Advanced Quality Checks

Each scan contains a "**glintlat**" and "**glintlon**" giving the location of the solar glint center at the time in the middle of that scan. Users can use these or the per-field-of-view "**sun_glint_distance**" to check for possibility of solar glint contamination.

Serious glint contamination of AMSU window channels (channels 1,2,3, and 15) is seen when the scene contains substantial water (landFrac < 0.5) and "**sun_glint_distance**" is less than ~50km.

"**qa_receiver_a11**", "**qa_receiver_a12**", "**qa_receiver_a2**", bits 2-6 and "**qa_channel**" bits 0-6 indicate conditions that can potentially, but not usually, impact data quality. Users who require pristine data should discard data when any of these bits are set.

Quick Start QA for HSB L1B Data

Per-Scan Quality Checks

Before using any HSB L1B brightness temperature, check the value of the corresponding "**state**" to ensure that it is equal to zero. There is one "**state**" value for all 90 fields-of-view of a scan, and it is valid for all four implemented channels. The "**state**" valids and their meaning are:

State Valid	State Value	Meaning
Process	0	normal data
Special	1	instrument in special calibration mode when these data were taken (e.g., staring at nadir)
Erroneous	2	data known bad (e.g., instrument in safe mode)
Missing	3	data are missing

Per-Channel Quality Checks

Individual channel readings ("**antenna_temp**" or "**brightness_temp**") must be checked for the flag bad value of **–9999.0**. A channel reading is set to this value by the PGE when it becomes suspect during processing.

HSB Channel 1 was never implemented, so will always be –9999.0.

HSB data are unavailable after February 5, 2003 due to instrument failure.

Advanced Quality Checks

Each scan contains a "**glintlat**" and "**glintlon**" giving the location of the solar glint center at the time in the middle of that scan. Users can use these or the per-field-of-view "**sun_glint_distance**" to check for possibility of solar glint contamination.

Some glint contamination is seen on HSB channel 2 when the scene contains substantial water (landFrac < 0.5) and "**sun_glint_distance**" is less than ~50km.

"**qa_receiver**" bits 2-6 and "**qa_channel**" bits 0-6 indicate conditions that can potentially, but not usually, impact data quality. Users who require pristine data should discard data when any of these bits are set.